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TITLE

PIF (Program Interrupt Facility for 3 TTY's)

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SOURCE LANGUAGE

PAL III

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DECUS Program Library Write-up

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STARTING THE PROGRAM

In order to start this program, set the switch register to 0200 and press Load Address. Then press Clear and Continue. You will see a rapidly counting AC. The TTY's are now ready for use. This program was originally devised to make it easier to type up a paper tape by putting in a Control/Tab and an automatic CR/LF.

As a demonstration program it can be used to show the speed of a computer by giving the illusion that it is doing many things all at once.

PROGRAM DESCRIPTION

PIF (Program Interrupt Facility for 3 TTY's) is a versatile Utility or Demonstration program. As it is presently set up the program is split up into five major parts.

1. The Background Program - This program is just a counting program that increments the AC after a delay of 4095 counts of a storage space. This is only used as a demonstration; this portion of the program may be changed to perform just about any function under an interrupt system.

2. The Identification Routine - This routine is the first routine entered after an interrupt is encountered. By a series of skip-on-flag instructions it is determined what device is calling for the interrupt. Once this has been ascertained, control is then put over to the control routines. (Note: If there is an interrupt called for by a device not specified in the Identification routine the program will halt with 0423 in the Program Counter.)

3. Control Routine - This is the main body of the interrupt system and is itself broken into two parts.

A. Input - This part first reads and shows the character input by the given TTY, stores the character and then clears the keyboard flag, therefore disenabling any further interrupts from that TTY until another character is typed on the keyboard. I then jump to a check subroutine (explained later) and return to the routine with three options:

- 1) If "HOLD" is 0 then the character was no special one and we return to the background program.
- 2) If "HOLD" is 1 then it is a Control/Tab and a counter is set up for the tabulation. Control is then returned to the background program.

3) If "HOLD" is -1 then it is a CR/LF and a switch is set up for the line feed and then control is returned to the background program.

B. Output - When this routine is entered the teleprinter flag is cleared therefore disenabling further interrupt from that device. Then there are again three choices:

1) If the counter that has been set up is 0 nothing is to be output, therefore control is returned to the background program.

2) If the counter is positive we have a Control/Tab and we must print out a space, check if it has been eight spaces and then return to the background program. If eight spaces have printed the counter is set to zero.

3) If the counter is negative it is a CR/LF and a Linefeed must be given, the counter cleared and control returned to the background program.

4. Check Routine - This routine checks for each type of character and returns to the input routine with three options:

- 1) If a normal character "HOLD" is set to 0.
- 2) If a Control/Tab "HOLD" is set to 1.
- 3) If a CR/LF "HOLD" is set to -1.

5. Program Interchange - This is located on the zero page and is a transfer routine. There are two stages of the interchange:

A. Interrupt Call Phase - When an interrupt is given, there is a JMS 0 operated by the computer and the PC. is automatically saved. Immediately the interrupt is turned off, the AC is saved and if desired the link can be saved. Control is then passed to the Identification routine.

B. Return Phase - The AC (link if desired) is returned to normal, interrupt turned on and control returned to the background program by a JMP I 0.

Different Devices for Input and Output - In the system that I have made for this program I use three ASR-33 TTY's. The device codes on them were Console, 40 and 42. Therefore all of my input-output instructions for the printers had to be defined to assemble the program in PAL III. At the end of the program listing is a list of defined input-output instructions for printing, reading, skip-on-flag and clear flag instructions. If it is desired to change either the device coding or the device altogether all you need to do is change the defined codes. To clarify how they are used I shall explain further.

TLS2=6416 means print a character on TTY number two
with a device code for output of 41

KRB3=6426 means read a character on TTY number three
with a device code for input of 42

The same follows for all other input-output instructions
for all devices and their corresponding input-output
codings.

Location of Different Routines

1. Background Program= 200-207
2. Identification Routine= 400-422
3. Control Routine-

Input-TTY1= 422-463
TTY2= 507-530
TTY3= 554-575

Output-TTY1= 464-506
TTY2= 531-553
TTY3= 600-622

4. Check Routine= 423-441
5. Program Interchange-

Interrupt Call Phase= 0.5
Return Phase= 20-22

Possible Program Modifications

1. Save Link Modification

```
*0000
0000 0000 ACCESS, 0
0001 6002 IOF
0002 3007 DCA AC
0003 7004 RAL
0004 3010 DCA LINK
0005 5406 JMP I SERVE
0006 0400 SERVE, USE
0007 0000 AC,0
0010 0000 LINK,0

*0020
0020 1010 RESTAR, TAD LINK
0021 7110 CLL RAR
0022 1007 TAD AC
0023 6001 ION
0024 5400 JMP I ACCESS
```

2. If a change in the background program is desired the whole routine may be changed from locations 0202 on up. But a word of caution must be given here. In the background program any input-output requested while the interrupt is on will cause a JMS 0.

The contents in 0200 and 0201 must remain the same and the program must be started at the same location always.

*0

ØØØØ	ØØØØ	ACCESS, Ø
ØØØ1	6ØØ2	IOF
ØØØ2	3ØØ5	DCA AC
ØØØ3	54Ø4	JMP I SERVE
ØØØ4	Ø4ØØ	SERVE, USE
ØØØ5	ØØØØ	AC, Ø
		*ØØØØ
ØØØØ	1ØØ5	RESTAR, TAD AC
ØØØ1	6ØØ1	ION
ØØØ2	54ØØ	JMP I ACCESS
		*ØØØØ
ØØØØ	6ØØ7	CAF
ØØØ1	6ØØ1	ION
ØØØ2	73ØØ	CLA CLL
ØØØ3	22Ø7	ISZ WAIT
ØØØ4	52Ø3	JMP . -1
ØØØ5	7ØØ1	IAC
ØØØ6	52Ø3	JMP . -3
ØØØ7	ØØØØ	WAIT, Ø
		*Ø4ØØ
Ø4ØØ	64Ø1	USE, KSF2
Ø4Ø1	741Ø	SKP
Ø4Ø2	53Ø7	JMP TTY2
Ø4Ø3	6411	TSF2
Ø4Ø4	741Ø	SKP
Ø4Ø5	5331	JMP_TTY20
Ø4Ø6	6421	KSF3
Ø4Ø7	741Ø	SKP
Ø41Ø	5354	JMP TTY3I
Ø411	6431	TSF3
Ø412	741Ø	SKP
Ø413	5776	JMP I TZY
Ø414	6Ø31	KSF
Ø415	741Ø	SKP
Ø416	5242	JMP TTY1I
Ø417	6Ø41	TSF
Ø42Ø	741Ø	SKP
Ø421	5264	JMP TTY10
Ø422	74Ø2	HLT
Ø423	ØØØØ	CHECK, Ø
Ø424	1Ø55	TAD HOLD
Ø425	1Ø53	TAD MBACK
Ø426	764Ø	SZA CLA
Ø427	5233	JMP . +4
Ø43Ø	7Ø4Ø	CMA
Ø431	3Ø55	DCA HOLD
Ø432	5623	JMP I CHECK
Ø433	1Ø55	TAD HOLD
Ø434	1Ø54	TAD CTRLTB
Ø435	764Ø	SZA CLA
Ø436	524Ø	JMP . +2

0437	7001	IAC
0440	3055	DCA HOLD
0441	5623	JMP I CHECK
0442	6036	TTY1I,KRB
0443	6046	TLS
0444	3055	DCA HOLD
0445	6032	KCC
0446	4223	JMS CHECK
0447	1055	TAD HOLD
0450	7450	SNA
0451	5020	JMP RESTAR
0452	7710	SPA CLA
0453	5262	JMP .+7
0454	1050	TAD SPACES
0455	3061	DCA COUNT1
0456	7001	IAC
0457	3056	DCA HOLD1
0460	7000	NOP
0461	5020	JMP RESTAR
0462	1055	TAD HOLD
0463	5257	JMP .-4
0464	6042	TTY10,TCF
0465	1056	TAD HOLD1
0466	7450	SNA
0467	5020	JMP RESTAR
0470	7710	SPA CLA
0471	5302	JMP .+11
0472	1051	TAD SPACE
0473	6046	TLS
0474	7200	CLA
0475	2061	ISZ COUNT1
0476	5020	JMP RESTAR
0477	5304	JMP .+5
0500	6042	TCF
0501	5276	JMP .-3
0502	1052	TAD LF
0503	6046	TLS
0504	7200	CLA
0505	3056	DCA HOLD1
0506	5300	JMP .-6
0507	6406	TTY2,KRB2
0510	6416	TLS2
0511	3055	DCA HOLD
0512	6402	KCC2
0513	4223	JMS CHECK
0514	1055	TAD HOLD
0515	7450	SNA
0516	5020	JMP RESTAR
0517	7710	SPA CLA
0520	5327	JMP .+7
0521	1050	TAD SPACES
0522	3062	DCA COUNT2
0523	7001	IAC
0524	3057	DCA HOLD2
0525	7000	NOP
0526	5020	JMP RESTAR

Ø527	1Ø55	TAD HOLD
Ø53Ø	5324	JMP . - 4
Ø531	6412	TTY20 , TCF2
Ø532	1Ø57	TAD HOLD2
Ø533	745Ø	SNA
Ø534	5Ø2Ø	JMP RESTAR
Ø535	771Ø	SPA CLA
Ø536	5347	JMP . +11
Ø537	1Ø51	TAD SPACE
Ø54Ø	6416	TLS2
Ø541	72ØØ	CLA
Ø542	2Ø62	ISZ COUNT2
Ø543	5Ø2Ø	JMP RESTAR
Ø544	5351	JMP . +5
Ø545	6412	TCF2
Ø546	5343	JMP . - 3
Ø547	1Ø52	TAD LF
Ø55Ø	6416	TLS2
Ø551	72ØØ	CLA
Ø552	3Ø57	DCA HOLD2
Ø553	5345	JMP . - 6
Ø554	6426	TTY3I , KRB3
Ø555	6436	TLS3
Ø556	3Ø55	DCA HOLD
Ø557	6422	KCC3
Ø56Ø	4223	JMS CHECK
Ø561	1Ø55	TAD HOLD
Ø562	745Ø	SNA
Ø563	5Ø2Ø	JMP RESTAR
Ø564	771Ø	SPA CLA
Ø565	5374	JMP . +7
Ø566	1Ø5Ø	TAD SPACES
Ø576	3Ø63	DCA COUNT3
Ø57Ø	7ØØ1	IAC
Ø571	3Ø6Ø	DCA HOLD3
Ø572	7ØØØ	NOP
Ø573	5Ø2Ø	JMP RESTAR
Ø574	1Ø55	TAD HOLD
Ø575	5371	JMP . - 4
Ø576	Ø6ØØ	TZY , TTY30 *Ø6ØØ
Ø6ØØ	6432	TTY30 , TCF3
Ø6Ø1	1Ø6Ø	TAD HOLD3
Ø6Ø2	745Ø	SNA
Ø6Ø3	5Ø2Ø	JMP RESTAR
Ø6Ø4	771Ø	SPA CLA
Ø6Ø5	5216	JMP . +11
Ø6Ø6	1Ø51	TAD SPACE
Ø6Ø7	6436	TLS3
Ø61Ø	72ØØ	CLA
Ø611	2Ø63	ISZ COUNT3
Ø612	5Ø2Ø	JMP RESTAR
Ø613	522Ø	JMP . +5
Ø614	6432	TCF3
Ø615	5212	JMP . - 3

Ø616	1Ø52	TAD LF
Ø617	6436	TLS3
Ø62Ø	72ØØ	CLA
Ø621	3Ø6Ø	DCA HOLD 3
Ø622	5214	JMP . -6
		*ØØ5Ø
ØØ5Ø	777Ø	SPACE8 , -8
ØØ51	Ø24Ø	SPACE , 24Ø
ØØ52	Ø212	LF , 212
ØØ53	7563	MBACK , -215
ØØ54	7567	CTRLTB , -211
ØØ55	ØØØØ	HOLD , Ø
ØØ56	ØØØØ	HOLD1 , Ø
ØØ57	ØØØØ	HOLD2 , Ø
ØØ6Ø	ØØØØ	HOLD3 , Ø
ØØ61	ØØØØ	COUNT1 , Ø
ØØ62	ØØØØ	COUNT2 , Ø
ØØ63	ØØØØ	COUNT3 , Ø
		TSF2=6411
		TSF3=6431
		KSF2=64Ø1
		KSF3=6421
		TLS2=6416
		TLS3=6436
		KRB2=64Ø6
		KRB3=6426
		CAF=6ØØ7
		SPF=6Ø4Ø
		SPF2=641Ø
		SPF3=643Ø
		TCF2=6412
		TCF3=6432
		KCC2=64Ø2
		KCC3=6422

AC	ØØØ5
ACCESS	ØØØØ
CAF	6ØØ7
CHECK	Ø423
COUNT1	ØØ61
COUNT2	ØØ62
COUNT3	ØØ63
CTRLTB	ØØ54
HOLD	ØØ55
HOLD1	ØØ56
HOLD2	ØØ57
HOLD3	ØØ6Ø
KCC2	64Ø2
KCC3	6422
KRB2	64Ø6
KRB3	6426
KSF2	64Ø1
KSF3	6421
LF	ØØ52
MBACK	ØØ53

RESTAR	ØØ2Ø
SERVE	ØØØ4
SPACE	ØØ51
SPACE8	ØØ5Ø
SPF	6Ø4Ø
SPF2	641Ø
SPF3	643Ø
TCF2	6412
TCF3	6432
TLS2	6416
TLS3	6436
TSF2	6411
TSF3	6431
TTY11	Ø442
TTY10	Ø464
TTY2	Ø5Ø7
TTY20	Ø531
TTY31	Ø554
TTY30	Ø6ØØ
TZY	Ø576
USE	Ø4ØØ
WAIT	Ø2Ø7

